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Investigating the Traits of Green Pepper in the Three Substrates in Hydroponic System

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Abstract: In order to investigate the properties of pepper fruit at different substrates as a factorial experiment in completely randomized design with four replications. The experiment was carried out in the Islamic Azad University, Jiroft branch, Iran, in 2011. Treatments included three green pepper cultivars (Sereno, LiricaRZ and Figaro) and three substrates of vermiculite + sand, peat + perlite and rock wool. Result showed that the most yield and average of fruit weight was 2003.91 and 129.14 g, respectively and number of fruit with average of 15.5, fruit length with 10.85 cm were obtained from substrate of peat + perlite. LiricaRZ had the most yield and average of fruit weight 1498.97 and 122.41 g, respectively than two other green peppers. There was significant interaction effect between green pepper and substrate in fruit's weight at 5% and fruit's length at 1%. It was known that the best substrate was peat + perlite and the best green pepper cultivar was LiricaRZ in hydroponic cultivation.

Keywords: Green pepper, interaction effect, peat, perlite, yield

INTRODUCTION

Nowadays, culture soilless is one of the main cultivated in the various techniques used in the horticulture. Cultivation of green pepper without soil have many advantages such as needless to disinfect the soil with gas, increasing the quality of product, reduce fungal and bacterial diseases, producing of fruits without pesticides, increasing of product season until 8 month and water efficiency is increased (Hassandokht, 2008). Vermiculite was consider as a culture medium of without soil and these is because of the ability to maintain water, nutrients and air and bulk density is low. Vermiculite is not only suitable culture medium, also is combine of vermiculite with sand, perlite or gravel which could be use as a suitable culture medium (Arzani, 2007). Cation exchange capacity is negligible, but sterile perlite is considered to be chemically inactivated. Properties of wool can be low cation exchange capacity, water supply, ventilation and the pH between the 8-7 (Hassandokht, 2008). Peat's pH was also low and included the capacity of keeping high water (Bunt, 1988).

Mousavi (2004) with investigated the effect of substrate and nutrient solution on quantitative and qualitative traits of green pepper at cultivate system without soil (hydroponic) declared that pure perlite was cause of significant decrease in yield, commercial yield, average of fruit weight, rate fruit's calcium, growing indices, rate of leaf's water and increasing the present of small fruits. Also, substrates which included 50-75% perlites were the cause of highest product of yield in green pepper. Albaho *et al.* (2009) with investigated the effect of three substrates on growing and yield of two green pepper cultivars reported that The pepper cultivars under study showed different responses to different cultural substrates, this substrates had significant effect on height, leaf number, chlorophyll index and total yield of plant. Abdollahi *et al.* (2007) reported that with increasing the peat's mixing was the cause that nitrogen and iron concentrations significantly increased and perhaps affect of increasing peat on yield in mixing culture medium was through increasing the amount of nitrogen, iron and zinc in various culture media. Nourizadeh *et al.* (2003) reported that the most high of cucumber, wet's weight of shoot plant, total yield, number of fruits at m^2 in every bush obtained from peat's substrate and the lowest yield was in the context of pure rice husk. In according to Mami *et al.* (2007) reports, the most total yield and marketable yield was related to tomato in cultivate system of soilless culture and highest rate of fruit and number of leaf was related to peat treatment + carbonate of rice husk.

This research was perform to objective of achieving suitable substrate in improvement yield and traits of green pepper under hydroponic cultivate system.

MATERIALS AND METHODS

Present project was perform in factorial experiment in completely randomized design with four replications in three substrates included vermiculite + sand (1:1), peat +

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perlite (1:1) and rock wool and three cultivars of green pepper (Sereno, LiricaRZ and Figaro). The experiment was carried out in the Islamic Azad University, Jiroft branch, Iran, in 2011. Pepper seeds for transplanting to the planting pans, were placed, then the seeding which were transfer to substrate had 4 or 5 leaf. In present research, Hoagland nutrient solution No. 1 was used as the base and each day was given it on plant in three stages of 20 min. PH of nutrient solution was regulating at 5.8±0.2. Average temperature of excrement was regulating at 18±2 at night and 25±2 at day. Relative humidity of green house moves between 60-70%.Yeild green pepper weighing during every period and determine their yield. Also, length and diameter of green pepper was measured and recorded. Finally, all data were analyzed by SAS software and Duncan test to compare the averages.

RESULTS AND DISCUSSION

Number of fruit: Results of analysis of variance showed that there was significant different between substrates from the point of view of number of fruit in level of 5% (Table 1). The most number of fruit obtained from substrate of peat + perlite by average of 15.5 (Fig. 1). Maybe, suitable of substrate of peat + perlite was cause of increasing grow and sometimes increasing in flowering and number of fruit in green pepper from the point of view of providing water and nutrition. Inden and Torres (2004) with compare four substrates of fiberglass, perlite + carbonate of rice husk, cypress skin and coconut's fiber on tomato and results showed that the most total yield and number of fruit obtained from perlite + carbonate of rice husk substrate.

Average of fruit's weight: Analyzing results of variance according to average of fruit's weight showed that there was significant difference between cultivars of green pepper at level of 1% (Table 1). LiricaRZ had the most and Figaro had the lowest effect on the average of fruit's weight respectively by average of 122.41 and 99.80 g. Also, according to analyzing results of variance showed that there was significant difference between substrates in level of 1% (Table 1). Maximum and minimum averages of fruit's weight were on substrates of peat + perlite and vermiculite + sand by average of 129.14 and 95.71 g,

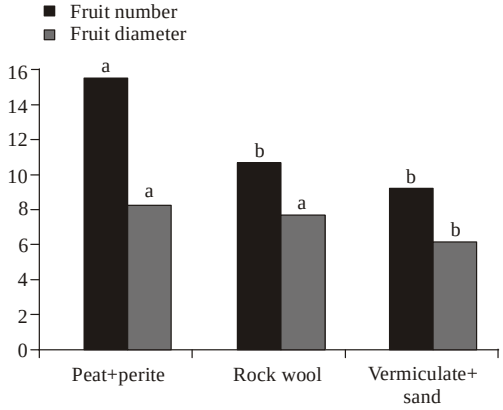

Fig.1 : Effect of culture substrate on the number and diameter of fruit

respectively. According to analyzing results of variance, there was significant difference on interaction effect of substrate and green pepper cultivars by average of fruit's weight at level of 5% (Table 1). Maximum and minimum average of fruit's weight was on LiricaRZ/peat + perlite and Figaro/vermiculite + sand by average of 139.28 and 86 g, respectively (Table 2). Available water was increase in perlite gradually. It seems that, increase in yield and fruit's weight in this substrate was due to this issue (Martinez and Abad, 1992). Tabatabaei and Mohamad-Rezaei (2006) reported that the wet weight of fruits in mixing treatment of perlite was increase.

Fruit's diameter: Analyzing results variance showed that there was significant difference between substrates from the point of view of fruit's diameter in the level of 5% (Table 1). Maximum diameter was related to substrate of peat + perlite and rock wool by average of 8.16 and 7.65 cm, respectively (Fig. 1). Nourizadeh *et al.* (2003) reported that there wasn't significant difference between experimental substrates from the point of view of greenhouse cucumber length, diameter and soluble solid material of fruit.

Length of fruit: Analyzing results of variance in green pepper's effect on length of fruit showed that there was significant difference between green pepper cultivars at

Table 1: Mean squares of studied traits

		M.S				
S.O.V	d.f	No. fruit	Fruit weight	Fruit diameter	Fruit length	Yield
Substrate (S)	2	105625.76**	6.26$^{n.s}$	2.69*	660.21**	40.68*
Cultivar (C)	2	294017.32**	14.54**	0.53$^{n.s}$	1545.29**	0.58$^{n.s}$
S×C	4	17979.22$^{n.s}$	1.33**	0.20$^{n.s}$	38.22*	0.41$^{n.s}$
Error	27	49791.29	1.44	0.37	26.50	3.34
C.V	%	8.50	5.12	5.51	3.11	8.45

**: Significant at 1%; *: Significant at 5%; Ns: Non-significant

Table 2: Interactions between cultivar and planting substrate on the studied traits

Cultivar/Substrate	Fruit length (cm)	Fruit weight (g)
Sereno/peat + perlite	11.02 b	127.40 b
LiricaRZ/ peat + perlite	12.47 a	139.28 a
Figaro/ peat + perlite	9.05 d	120.76 c
Sereno/stone wool	9.92 c	105.19 d
LiricaRZ/stone wool	11.10 b	122.20 c
Figaro/ stone wool	9.20 d	92.66 e
Sereno/vermiculite + sand	7.78 e	95.39 e
LiricaRZ/vermiculite + sand	8.67 d	105.74 d
Figaro/vermiculite + sand	7.40 e	86.00 f
Sereno/peat + perlite	11.02 b	127.40 b

Values with different letter are significantly different

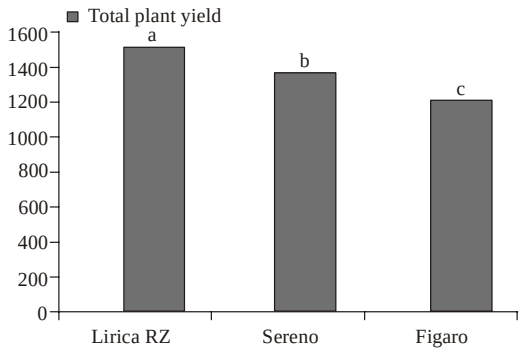

Fig. 2: Yield of pepper cultivars

level of 1% (Table 1). LiricaRZ by average of 10.75 cm and Figaro by average of 8.55 cm had maximum and minimum length of fruit. There was significant difference between interaction effect of substrate and cultivars on length of fruit at level of 1% (Table 1). Maximum length of fruit obtained from LiricaRZ/peat + perlite by average of 12.47 cm and minimum length of fruit obtained from Sereno/vermiculite + sand and Figaro/vermiculite + sand by average of 7.78 and 7.40 cm, respectively (Table 2). Measurement of plant growth factors showed that peat and perlite substrate's had a positive effect on fruit growth indices. Increase of peat was due to increase of nitrogen and iron in culture medium and put high effect on fruit's yield (Mami *et al*., 2007). Also, perlite provided better medium for root's grow and prevent from consume more water use and therefore produce more fruit (Djedidi *et al*., 1999).

Yield: There was significant between green pepper cultivars and substrates at level of 1%, but there was no significant interaction effect between substrates and green pepper cultivars (Table 1). LiicaRZ and Figaro had maximum and minimum fruit weight with average of 1498.97 and 1186.38 g, respectively (Fig. 2). Also, substrate of peat + perlite by average of 2003.91 g and vermiculite + sand by average of 817.92 g had maximum and minimum effect on fruit weight (Fig. 3). Application of peat only at cultivation of plants shows lack of food's element. If it combines with mineral soil, have

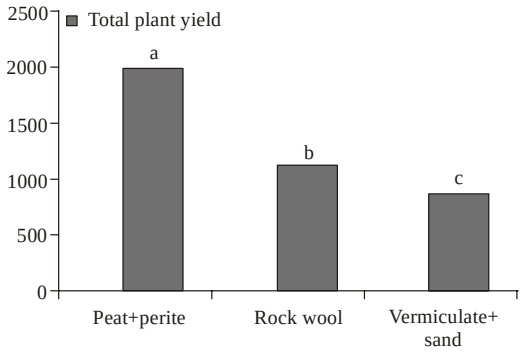

Fig. 3: Effect of culture substrate on yield

effectiveness effects on plants grown and this is due to the roles of peat on chemical reactions on providing and balancing nutritious elements (Bunt, 1988). Also reason is in the amount of nutrients in the environment and their ability to hold more food and water (Walters, 1990). Perlite is discussed as a substrate with very good traits in culture soilless because of high absorption water, increase of irrigation efficiency, ability of reusing substrate in next cultivate and finally decrease in production costs (Djedidi *et al*., 1999). Botez and Popescu (1995) reported the effect of peat in improvement grow of tomato and quality of fruit in relate to soil culture medium and this was due to the rate of more nutritious in these medium and abilities of their in keeping more nutritious and water.

CONCLUSION

Plants get food's absorption and suitable grow, optimize consuming water and keeping oxygen by using organic and inorganic cultivation. Therefore, it is necessary to select best substrate between several materials to produce plants. By attention to the effect role of peat on chemical reaction in providing and balancing nutrition element and also effect role of perlite on consuming water, then can be expressed that both of these two factors effect on capacity keeping of nutritious soluble, better exchanging of elements, especially cations inside substrate and suitable distribution of humidity in root and finally affect on forming root's system, absorption of foods element and plant grow. Substrate of peat + perlite and rock wool and vermiculite had maximum and minimum effect on the traits of green pepper. Therefore, LiricaRZ was known as a best substrate of peat + perlite.

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